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6.—FOSSILS FROM THE WOORAMEL DISTRICT, SERIES TWO.

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INTRODUCTION.

Various collections made in the Wooramal River District since 1929 have yielded a number of new species, and also better specimens of those previously described (Roy. Soc., W.A., Vol. XVII., 1931).

Most of the fossils are from the "Irwin" Horizon near Callytharra Spring. They include two species of *Pustula*, both new, a true *Seminula*, two species and a new variety of *Spiriferina*, a *Linoprotectus* slightly different from the typical *L. tenuistriatus* var. *foordi*, and a number of better specimens belonging to the *Productus semireticulatus* group. Of these, *Spiriferina* has not been recognised from the beds of the "Irwin" Horizon on the Irwin River, and although tiny specimens of *Pustula* have been found in collections from the Fossil Cliff Beds on the Irwin River, they have not been recognised as either of the species described below.

Fossils from the "Deltpecten" Horizon include a fine series of a new species of *Dielasma*, a large *Spirifer* somewhat similar to specimens from Selection Homestead, Kimberley Division, casts of *Myalina* and *Stutchburia*, and better specimens of *Cardiomorpha blatchfordi* and *Conularia warthi* which confirm previous suggestions. A specimen of *Deltpecten illawarrensis* (a species which has been previously recorded from the Gascoyne and Wyndham Rivers (G.S.W.A. Bull. 36, p. 90) found "east of Top Camp" may also come from the same horizon.

DESCRIPTIONS OF THE FOSSILS.

Genus *DIELASMA*, King.

(Dublin Natural History Review, Vol. VI., p. 519, 1859.)

Dielasma trigonopsis, n. sp.

Plate III., figs. 1a-c; Plate IV., figs. 1a-b and 2.

Description.—A large shell with the greatest breadth near the anterior margin which is almost a straight line so that the shell is almost an equilateral triangle with the angles bluntly rounded. The shell is punctate, thin, smooth, and ornamented only by numerous well-marked growth lines.

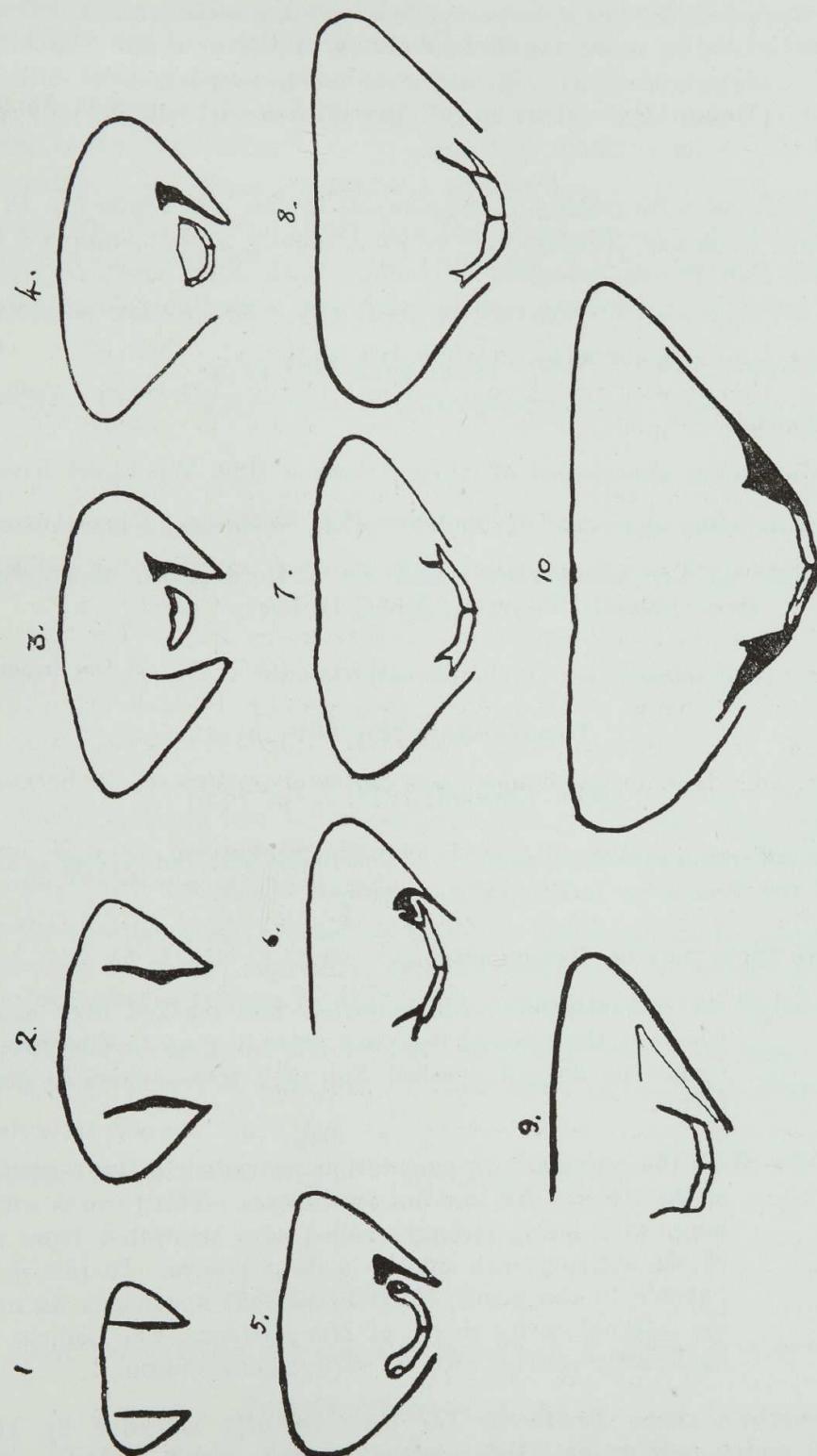
The pedicle valve is very shallow, gently curved longitudinally, flat transversely in the young shell, but at an early stage developing a broad open sinus which towards the front margin occupies the whole breadth of the shell making it concave transversely. The sinus appears at about one-third of the total length of the shell from the umbo. The foramen is very large and oblique. Its lower lip overhangs the umbo of the brachial valve. The umbonal flanks of the pedicle valve meet the ventral surface at less than a right angle, thus forming two sharp ridges diverging from the umbo separating the umbonal flanks from the main portion of the valve.

The brachial valve is almost straight longitudinally but strongly vaulted transversely, with straight sides sloping from an elevated flattened central portion. A faint sinus is present on the elevated central portion on some specimens. On one specimen the presence of this faint sinus forms two rounded ridges, one on each side, diverging from a point a short distance below the umbo.

Internal Structure.—In broken specimens crystallisation of the matrix in concentric rings inside the shell gives a false impression of spiral brachidia which, however, are not present. In the pedicle valve there are well developed dental plates. In the brachial valve there is a concave plate between the crural lamellae extending about half the length of the valve. This plate rests on the inner surface of the valve along the median line and joins the crural lamellae a little above their bases, thus forming a pair of slender cavities converging from the general cavity of the shell towards the beak. The crural lamellae are comparatively short. The specimen sectioned had the walls of the dorsal valve broken in places, confusing the appearance of the section which did not show whether or not the crural lamellae and dental sockets had an independent origin. Sections were very similar to those of *Hamburgia*, Weller,* in which the two are not independent, but in *Hamburgia* one of the characters distinguishing the genus from *Dielasma* is that the concave plate is not attached along the median line as shown on this specimen. If the independent origin of the crura is not proved when fur-

* Mississippian Brachiopoda Geol. Survey, Illinois, 1914, p. 282.

ther specimens are available for sectioning, it may be necessary to erect a new genus for the reception of this species.



Text figure 1—A series of sections through the umbonal portion of *Dielasma trigonopsis*
1 and 2 pedicle valve with dental plates, 3-10 both valves.

Dimensions—

	I.	II.	III.
	mm.	mm.	mm.
Length of shell	63	73	abt. 58
Length of brachial valve	56	63	54
Greatest breadth of shell	55	73	58
Greatest thickness of combined valves	29	27	21
Apical angle of pedicle valve	57°	abt. 85°	...
Apical angle of brachial valve	abt. 100°	...	abt. 100°

The emended genus *Productus* is characterised by having a narrow hinge, the concentric ornamentation not prominent, a long spreading trail on the pedicle valve and a diaphragm round the anterior margin of the visceral disc. No diaphragm can be detected in the broken specimens of group (a), and specimens of both groups are excluded from the emended *Productus* by the width of the hinge, the prominence of the reticulate ornamentation, and the trail which is not "spreading."

According to the latest nomenclature then, it would be necessary to erect a new genus for the Western Australian *P. semireticulatus*. More and better specimens are necessary before this multiplication of new names is justifiable.

Geological Survey Nos. $\frac{1}{4966}$ brachial valves.

$\frac{1}{4967}$ (a) and (b) pedicle valves.

Locality: Creek $\frac{1}{2}$ mile west of Callytharra Spring, Wooramel River.

Genus LINOPRODUCTUS, Chao

(*Productidae of China*, Pt. I., Pal. Sinica, Peking, ser. B, Vol. V., fasc. 2, p. 128.)

Linopproductus cf. *L. tenuistriatus* de Vern., var. *foordi*, Eth. jun.

Plate IV., fig. 3.

These finely costate shells differ from the typical *L. tenuistriatus*, var. *foordi*, chiefly in being less ventricose and more transverse. The ribs seem to spread more on the venter, whereas in *L. tenuistriatus*, var. *foordi*, the ribs on the venter are almost parallel.

All the specimens are crushed so that it is impossible to be certain that the differences of shape, convexity, and ornamentation on better specimens would be pronounced enough to distinguish them as a separate species.

Imperfect specimens of similar less ventricose forms have been noticed in collections from a buff limestone of Holmwood, Irwin River District.

Geological Survey No. $\frac{1}{4969}$.

Locality: Creek $\frac{1}{2}$ mile west of Callytharra Spring.

Genus PUSTULA, Thomas.

(*Mem. Geol. Surv. Great Britain, Palaeont.*, Vol. I., pt. 4, p. 259, 1914.)

Pustula senticosa, n. sp.

Plate III., figs. 2-3.

Description.—Shell broad, semi-circular to subquadrate, breadth about one and a half times the length, hinge line less than greatest breadth of shell. The pedicle valve is only gently convex, not at all swollen, with about the same convexity transversely as longitudinally. The umbo is acutely pointed and incurved, sharply marked off from the ears near the hinge margin by steep slopes which flatten out abruptly further from the hinge margin. The

Remarks.—A closely similar form is *D. spatulatum*, Girty,* from the Carboniferous of North America. *D. spatulatum*, however, differs from *D. trigonopsis* in having a deeper pedicle valve, a more pronounced sinus on the brachial valve, more angular junctions of the umbonal slopes with the ventral surface, and finally in being a much smaller shell—although the description says “shell rather large” the illustration, which is apparently natural size, is only 22mm. in length.

Two forms approaching *D. trigonopsis* in size and shape are *D. nobilis*, Eth. jun.,† from near Mingenew, Western Australia, and *D. latouchei*, Diener,‡ from the Salt Range limestone of India. Both differ from *D. trigonopsis* chiefly in having a trilobate pedicle valve with a median fold or ridge.

Geological Survey Nos.:— $\frac{1}{4} \frac{9}{9} \frac{5}{5} 0$, $\frac{1}{5} \frac{2}{2} \frac{3}{3} 2$ and $\frac{1}{5} \frac{2}{2} \frac{4}{4} 1$.

Localities:—

Two miles almost east of Survey Station R20, Wooramel River.

Two miles south-east of Madeline Hill, Wooramel River District.

Between Callytharra Road and No. 2 Bore Road, about five miles from Bogadi, Wooramel River District.

Genus PRODUCTUS, Sowerby.

(Min. Conchol. 1814, i., p. 153.)

The collection includes a number of specimens with the typical ornamentation of the *Productus semireticulatus* group.

Two types may be distinguished:—

- (a) With the reticulate ornamentation well marked over nearly the whole of the visceral disc and extending on to the ears. These specimens are all crushed but they were evidently geniculate forms.
- (b) With the reticulate ornamentation restricted to the posterior part of the visceral disc and not on the ears. This form is wider than long, with large, strongly rolled ears separated from the rest of the shell on each side by a deep groove. In this it is comparable to the genus *Marginifera*, but specimens do not show the internal shelly ridges of *Marginifera*. The pedicle valve is moderately convex with an abrupt geniculation.

Sowerby's genus *Productus* has been recently emended by H. Muir Wood,§ and a new genus *Dictyoclostus* erected which includes *P. semireticulatus* in part. The Wooramel specimens are excluded from *Dictyoclostus* by their geniculate form.

* The Guadalupian Fauna, G. H. Girty, U.S.G.S. Prof., Paper 58, 1908, p. 320, pl. xvi., figs. 3-4c.

† G.S.W.A. Bull. 27, 1907, p. 19, pl. IV., figs. 2-4, pl. VI., figs. 1-2.

‡ Himalayan Foss. Pal. Ind. Ser. XV., vol I., pt. v., p. 111.

§ H. Muir Wood, Ann. and Mag. Nat. Hist. Ser. X., Vol. V., 1930, p. 100.

venter is low, gently sloping to the lateral and anterior margins. The ears are broad, flattened, not sharply marked off from the lateral slopes; cardinal angles obtuse. The ornamentation is of fine, erect spines emerging practically at right angles to the shell and arranged roughly in quincunx. There are about four spines in the space of three millimetres measured transversely, and three in the same space measured longitudinally. On close examination fine concentric growth lines are to be seen, particularly on the ears, but the lack of any marked concentric ornamentation is one of the chief features of the species.

The brachial valve is strongly concave and follows the contour of the pedicle valve very closely, curving in under the umbo to a remarkable degree. It shows the same ornamentation as the pedicle valve, but the spines towards the anterior margin are not perpendicular but slope radially. The concentric growth laminae are slightly more noticeable than on the pedicle valve.

The shell of both valves is very thin. This and the close association of the two valves leads one at first to suppose that only the pedicle valve is present. The internal features of the pedicle valve are unknown and those of the brachial valve only partly exposed. The cardinal process is short and very broad considering the small size of the pedicle umbo. On the ventral surface it is divided by a broad furrow into two rounded prominences, each of which bears a cup-like depression at the posterior end. Below the cardinal process is a fine thread-like median septum which extends a little over a third of the length of the shell. A brachial ridge, faintly seen, extends downwards and outwards from the base of the cardinal process in a gently sloping curve to the level of the anterior end of the median septum where it curves upwards again and ends at about two millimetres from the septum at about the middle of its length.

Dimensions—

	I.	II.	III.
	mm.	mm.	mm.
Length of pedicle valve	18	21	...
Breadth of pedicle valve	23	32	31
Length of brachial valve from hinge line to anterior border	15
Length of brachial valve from end of cardinal process	23
Length of hinge line	17	23	...

Remarks.—*P. senticosa* approaches nearest to *P. spinulosa*, J. Sowerby,* which has a delicate shell with an acute umbo and bears fine erect spines. *P. spinulosa*, however, differs in general shape, narrowing rapidly towards the anterior margin, has the hinge almost as long as the greatest breadth of shell and has wrinkles on the ears.

Another similar species is *P. carringtoniana*, Davidson,† which is similar in shape, and the depressed profile of the shell but differs in having a marked concentric ornamentation and fewer scattered spines.

* I. Thomas. Mem. Geol. Surv. Grt. Britain Palaeont. Vol. I. pt. 4 p. 314.

† I. Thomas loc. cit. p. 324.

The nearest Indian species having an ornamentation of fine spines is *Productus humboldti*, d'Orbigny.* This is a much more robust, convex shell with a distinct median sinus in the pedicle valve.

Geological Survey No. 4970 (a).

Locality: Creek: $\frac{1}{2}$ mile west of Callytharra Spring, Wooramel River.

Pustula micracantha, n. sp.

Plate IV., figs. 4 a and b.

Description.—Shell broader than long, semi-circular to sub-quadrangular, length of hinge almost equal to greatest breadth of shell. Cardinal angles almost right angles. Pedicle valve moderately convex. In profile the venter is gently curved but the curvature is more pronounced towards the anterior margin. In two of the three specimens there is a well-marked geniculation. The umbo is small, not overhanging, and the flanks slope gently to the lateral margins. The ears are not marked off from the umbonal flanks. The shell is ornamented with spine bases, slightly recumbent, arranged more or less in concentric rows, alternating in succeeding rows so that they are roughly in quincunx. There are about three spines in the space of three millimetres. On the ears and umbo there is a series of concentric folds which die out on the anterior portion of the shell.

The brachial valve is deeply concave with an abrupt geniculation following the contour of the pedicle valve. The ornamentation can only be seen on the ears and round the margin where there are irregular concentric folds and scattered spine bases.

The internal characters are unknown except that the median septum, seen through the shell, extends to about a third of the length of the brachial valve.

The very thin shell and the shallowness of the visceral cavity make the combined valves scarcely greater in thickness than a moderately thick pedicle valve. This shallowness may have been accentuated by compression as all the specimens show evidence of slight crushing. However, as the dorsal valve is not much broken, the amount of thickness lost by crushing must have been slight.

Dimensions:—

		I.	II.	III.
Length of pedicle valve	mm.	mm.
Length of brachial valve	14	14
Maximum breadth	12	13
Length of hinge line	17	11
Depth of combined valves	15	15
			1½	14
			2	...

Remarks.—Thomas (p. 259) divides the genus *Pustula* into several series. Of these, *P. micracantha* belongs to series (c) containing geniculate forms

* Waagen Salt Ra. Foss. (Pal. Ind. 1884) I., IV., fasc. 4, p. 696.

such as *P. plicatilis* but differs from the members of this series in all respects other than the geniculation. The closest British forms are *P. spinulosa** and *P. carringtoniana*.† *P. micracantha* differs from *P. spinulosa* in outline, has a less pronounced umbo and less crowded spines. It agrees with *P. carringtoniana* in outline, long hinge line and ornamentation of spines, but *P. micracantha* has less marked concentric ribs and more numerous, regularly arranged spine bases.

P. micracantha differs from *P. senticosa* in being geniculate and more strongly convex, in having the umbo not definitely marked off from the lateral slopes and an ornamentation of less crowded spines with concentric folds on ears and umbo.

In general appearance *P. micracantha* is very similar to numerous members of the genus *Productella*, Hall,‡ but has not the area characteristic of this genus.

Geological Survey No. $\frac{1}{4}970$ (b).

Locality: Creek $\frac{1}{2}$ mile west of Callytharra Spring, Wooramel River.

Genus SEMINULA, M'Coy (non Hall and Clarke, Schuchert, et al.).

Genotype *S. pentaedra*, Phil. M'Coy Carb. Foss., Ireland, p. 150, fig. 31.)

Seminula callytharrensis, n. sp.

Plate V., 2-5.

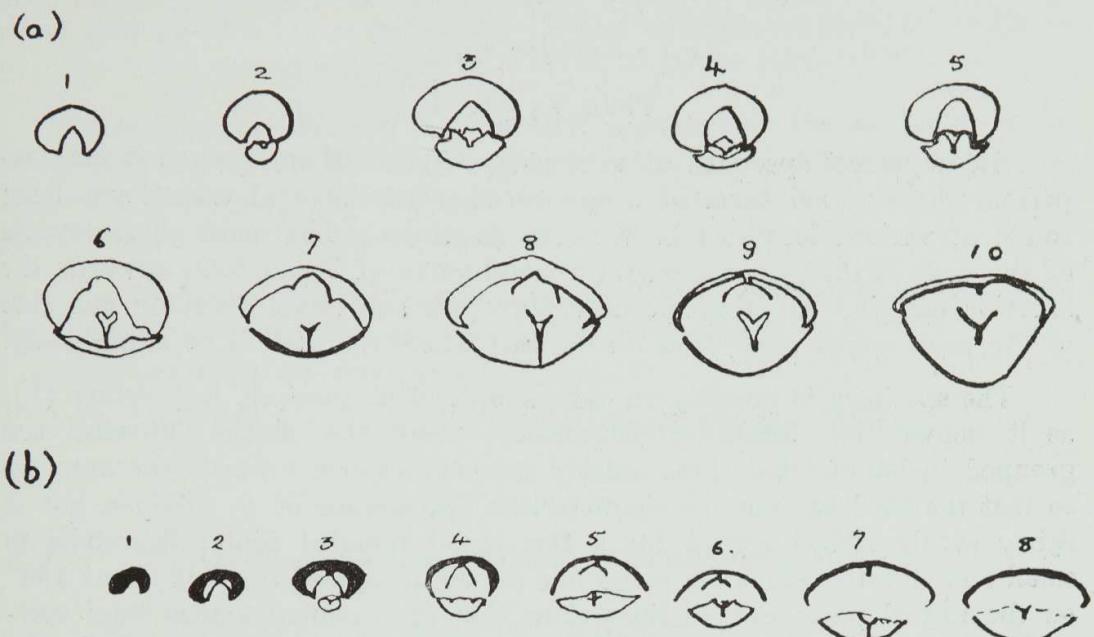
Description.—Shell circular to oval, biconvex, convexity varying. Pedicle valve has approximately the same convexity longitudinally as transversely; umbo moderately incurved with a small perforation (this is broken on several specimens, giving a false impression of a large foramen). The sinus is only seen towards the anterior margin. It may cause only a gentle wave in the margins of the valves, or if the pedicle valve is strongly produced anteriorly it may cause a pronounced insinuation of the margin without a correspondingly marked depression on the pedicle valve or fold on the brachial. Brachial valve more convex transversely than longitudinally, with no defined median fold. Surface of both valves smooth, marked with a few widely spaced growth lines, about seven, in an individual nineteen millimetres long.

Internal characters.—In the pedicle valve the dental plates are continued anteriorly into a spondylium raised above the floor of the valve on a short median septum which is continued anteriorly a short distance beyond the limit of the spondylium. In the brachial valve the hinge plate is supported on a median septum which also supports a concave cruralium. This becomes more highly elevated anteriorly. The two series of sections, (a) of a larger more convex shell, (b) of a smaller flattened circular shell, both show these characters. Although the cruralium is well shown its presence underlying (dorsal to) the hinge plate of the brachial valve, as shown in sections of *Camarophoria* by Weller (Miss. Brach., p. 169, figs. C. D. and E.) could not

* Thomas loc. cit., p. 314. † Thomas loc. cit., p. 324.

‡ Hall and Clarke Intro. to Study of Brachiopoda Rept. State Geologist of New York for 1891, 1892, p. 298.

be made out with any certainty. It appears to have been present; compare figs. (a) 3 and 4, (b) 3 and 5, with Weller, figs. C. to E.



Text figure 2—Two series of sections through the rostral portion of *S. callytharrensis*. Slightly enlarged. (a) shows internal structure of the brachial valve better than the pedicle which is much thickened; (b) shows dental plates, spondylium and septum of the pedicle valve but the internal structure of the brachial valve is obscured by the valve's being filled with crystalline calcite.

Dimensions—

	mm.
Length of pedicle valve ...	19
Length of brachial valve ...	16
Maximum breadth ...	18
Maximum thickness ...	11

Remarks.—Although it is very similar in external appearance, this species should not be confused with a species previously recorded from the Kimberley Division as *Seminula* cf. *S. subtilita*, Hall (Univ. Nos. 2507 and 2510). Those shells commonly referred to the genus *Seminula*, including Hall's *S. subtilita*, have been shown by Buckman* to belong to *Composita*, Brown, a genus of spire-bearing shells. The Kimberley specimens, which are definitely spire-bearing, are therefore *Composita* cf. *C. subtilita*.

Seminula, M'Coy, according to Buckman, is then properly applied to pentamerid genus, which includes *Camarophoria*, although this may possibly be distinguished as a sub-genus. *S. callytharrensis*, having the pentamerid internal structure closely comparable to that of *Camarophoria schlotheimi*, differs from species of this sub-genus in the total absence of plications.

The genus *Camarophorella*, Hall and Clarke, including similar non-plicate shells, was originally considered to be closely allied to *Camarophoria*, but Weller† points out that it has since been shown that the shells included in *Camarophorella* are spire-bearing.

Geological Survey No. 4979.

Locality: Creek $\frac{1}{2}$ mile west of Callytharra Spring.

* Ann. and Mag. Nat. Hist. 7th Ser. Vol. XVII., p. 324.

† Miss. Brach. 1914, p. 458.

Genus SPIRIFER, J. Sowerby.

(Mineral Conchol., 1816, II., p. 41.)

Spirifer sp.

Plate V., Fig. 1.

An imperfect specimen of a large *Spirifer* is of interest as it may represent the external form of a species of which internal casts have been found at various localities in Western Australia. The main characteristic of the casts is the presence on the ventral valve of broad folds towards the anterior margin. On this specimen there are two broad folds on one side of the valve which also show on the cast where the shell is breaking away.

The specimen is possibly an old example of *S. fasciger*, Keyserling (1), as it shows the following characters:—near the umbo the ribs are grouped in bundles but these quickly become obsolete towards the anterior so that the shell has not the characteristic appearance of *S. fasciger*, but is fairly evenly ribbed except for a few broad rounded folds; the umbo is small and elevated above the hinge line giving an apical angle of about 130° on the rostral part; growth lines show that the cardinal angles were rectangular or rounded, not acute; in a few less worn parts of the shell the growth lines give some indication of the projecting laminae characteristic of *S. fasciger*.

Specimen No.: Geological Survey $\frac{1}{5231}$.

Locality: Two miles south-east of Madeline Hill.

Genus SPIRIFERINA, D'Orbigny.

(Comptes Rendus 1847 XXV., p. 268; Hall and Clarke, Pal. New York 1894 VIII., pt. 2, p. 51.)

Spiriferina cristata, Schlotheim.

Plate IV., fig. 5.

1816 *Terebratulites cristata*, Schlotheim, Beitr. Naturges. Verstein., Akad. Wissen, Munchen, t. 1, fig. 3.

For further synonymy see

1883. *Spiriferina cristata*, Waagen. Salt Ra. Foss. (Pal. Ind. Ser. XIII.), p. 499, pl. 49, figs. 3-7.

1897 " " Diener, Himal. Foss. I., pt. 3 (Pal. Ind. Ser. XV.), p. 39, pl. 7, figs. 5-7.

1902 " " Dun, Records G.S.N.S.W. Vol. VII., pt. 2, p. 86, pl. XXI., figs. 15-16.

Two pedicle valves represent this species. The shell is moderately convex, breadth about one and a half times the length; hinge line equal to greatest breadth of shell, cardinal angles rounded; area triangular, concave with

(1) Reise in das Petschoraland 1843, p. 229, t. 8, f. 3. For synonymy with *S. musakheylensis* see Ethridge, Geol. Surv. W.A. Bull 10, p. 12, 1903, or Diener, Himal. Foss (Pal. Ind. Ser. XV.), 1897 1, pt. 3, p. 43; pt. 4, p. 35; 1899, pt. 2, p. 63; and 1903, pt. 5, p. 106.

horizontal growth lines; delthyrium wide, dental plates well developed, a median septum present. Surface of shell with four folds on each side of a deep sinus, crossed by well marked concentric growth lines. Test perforated, about four punctae to one millimetre. Where unweathered there are scattered papillae which apparently close up a series of larger perforation.

Several authors describe the area of *S. cristata* as "almost at right angles to the plane of the smaller valve." This is not so in the Wooramel specimens. Davidson, however, points out that the "disposition of the area is very variable." (Mon. Carb. Brachiopoda, p. 38.)

The Wooramel specimens differ from those from the Salt Range described by Waagen in having the area devoid of perforations.

Geological Survey No. $\frac{1}{4971}$ (a).

Locality: Creek $\frac{1}{2}$ mile west of Callytharra Spring, Wooramel River.

Spiriferina cristata, Schloth. var. *decipiens*, n. var.

Plate IV., figs. 6-7.

A number of specimens of *Spiriferina* are similar to those described above, but have an ornamentation of from four to six folds on the pedicle valve and from five to seven on the brachial valve. The folds flanking the sinus on the pedicle valve are about twice the size of the next pair. The third pair where present are much smaller again. On the brachial valve the first rib on each side of the central one is about half its height. The second is much smaller and the third scarcely discernible.

There are about 4-6 perforations in the space of one millimetre. In less weathered portions of the specimens these are not apparent. Scattered tubular papillae may or may not be present. Some specimens show none, others have a few towards the anterior margin, others again show papillae over the whole surface but becoming more crowded, 2 or 3 per mm. towards the anterior margin.

These specimens differ from *S. cristata*, Schloth., only in the number of folds present on each valve, but as *S. cristata* includes forms having up to fourteen ribs, and as these forms with less than eight are characteristic of the Wooramel beds, it seems advisable to distinguish them by using a varietal name.

S. cristata, var. *decipiens*, agrees with *S. permiana*, King,* in ornamentation, but differs in the larger size of the perforations. *S. insculpta*, Phillips,† similarly has a few bold folds but differs in the more swollen character of the folds and narrower furrows, smaller beak and more closely spaced growth lines.

Geological Survey No. $\frac{1}{4971}$ (e).

Locality: Creek $\frac{1}{2}$ mile west of Callytharra Spring, Wooramel River.

* King. Mon. Perm. Foss, 1850, p. 133. † Dav. Mon. Carb. Brach, 1858, p. 42.

Spiriferina papilionata, n. sp.

Plate VI., figs. 1-2.

Description.—Triangular shell, elongated transversely, hinge line forming greatest breadth of shell, cardinal angles acute and from them the lateral margins slope abruptly to the anterior border forming narrow, acutely pointed wings; shell moderately convex, umbo acute and slightly incurved over the area which is broad, concave, at first reclining at right angles to the plane of the brachial valve but curving and becoming upright under the umbo; area showing horizontal growth lines but without vertical striae. The pedicle valve is ornamented with two folds on each side of the median sinus. Of these the pair limiting the sinus are high and acute, over twice the size of the succeeding folds. There may be a third rib on each side of the wing, but this does not appear on the umbonal flanks and is only faintly visible towards the margin of the shell. The sinus is deep with the centre flattened and sharply delimited from the steep sides of the adjoining folds. The growth lines are evenly spaced, very prominent and strongly waved where they cross the folds. The shell is minutely punctate, from four to six perforations in the space of one millimetre. These perforations are not seen on the area. The surface of the valve lacks the papillae usually characteristic of the genus but this is probably due to the worn character of the specimens.

In the interior of the pedicle valve there are strong dental plates and a prominent median septum which extends over half way to the margin of the valve and projects in a high peak just below the dental plates.

A damaged specimen shows portion of a brachial valve. This has a high median fold flanked on each side by a smaller fold. On each side of this small fold the shell is narrowed abruptly to an elongated alar portion similar to the corresponding portion of the pedicle valve.

The dimensions given below are only approximate as all the specimens are damaged at the margins. The very regular growth lines, however, show that the shell must have been about twice as broad as long.

Dimensions—

		I.	II.
Length of pedicle valve	...	mm. 15	mm. 17
Length of brachial valve	mm. 12
Breadth at hinge line	...	mm. 26-28	mm. 28
Depth of pedicle valve from hinge to centre of sinus	...	mm. 9	...
Height of area	...	mm. 5	...
Width of delthyrium at hinge	...	mm. 4	...

Remarks.—*S. papilionata* agrees with *S. cristata*, Schlothe., in the closely punctate structure of the test, also in the shape of the sinus quoted by Diener, pt. III., p. 42, "the bottom forming an even plane and marked off by sharp borders from the adjoining lateral portions," but it is distinguished from *S. cristata* by the sharply pointed wings, by the more acute zig-zag lines formed by the growth lines crossing the folds and by the possession of only four marked folds on the pedicle valve and three on the dorsal—those specimens of *S. cristata* having so few ribs are young forms "not exceeding 1½ lines in breadth."

Geological Survey No. 4971 (b).

Locality: Creek ½ mile west of Callytharra Spring, Wooramal River.

Genus CARDIOMORPHA, De Koninck.

(Anim. Foss. Terr. Carb. Belg. 1842, p. 101.)

Cardiomorpha blatchfordi, Hosking.1931 *Cardiomorpha blatchfordi*, Hosking, Royal Soc., Western Australia, Vol. XVII., p. 30, pl. VII., figs. 4 and 5.

Plate VI., fig. 3.

An incomplete specimen of the combined valves shows more of the shell of this species than the specimens originally described. The shell is comparatively thin, ornamented with concentric ridges which are finer on the anterior than on the posterior slope where there are five or six in the space of 5mm. Here they are sharp and separated by deep sulci. Where the shell is broken away the coarse concentric rugae before described are seen on the cast.

Geological Survey No. $\frac{1}{4951}$.

Locality: Two miles almost east of Survey Station R20, south bank of Wooramel River.

Genus DELTOPECTEN, Etheridge junior.

(Geol. and Pal. Queensland and New Guinea, p. 269, 1892.)

Deltopecten illawarensis, Morris.

Plate VI., fig. 4.

1845 *Pecten illawarensis*, Morris, Strezlecki's Phys. Descr. N.S.W. and Van Diemen's Land, p. 277, pl. 14, fig. 3.1906 *Deltopecten illawarensis*, Eth. jun. and Dun, Mem. Geol. Surv. N.S.W. Palaeont. No. 5, Vol. II., pt. 1, p. 24, pl. II., figs. 2 and 3.

A single shell, remarkable for its size and its regular ornamentation of coarse ribs, is placed in the species *D. illawarensis* on the evidence of shape and ornamentation. Additional specimens showing the hinge line are necessary to determine whether the reference to the genus *Deltopecten* is correct.

The shell is apparently a right valve, equilateral excluding the ears, slightly longer from the dorsal to the ventral margin than from anterior to posterior margins, convex for over two-thirds of its length but with a pronounced flattening towards the ventral and latero-ventral margins. There are twenty-six strong, broad ribs, very regularly arranged, separated by a little over half their own width, and crossed by very close concentric laminae. The anterior ear is large, triangular with rounded outer margin, and separated from the shell by a deep byssal sinus. It is ornamented with six or seven coarse costae crossed by innumerable concentric laminae. The posterior ear is broken away.

Dimensions:—

	mm.
Dorsal-ventral length	156
Antero-posterior length	150
Approximate depth of single valve	30
Length from umbo to anterior end of hinge	55

Remarks.—As Etheridge and Dun point out, there is some doubt about the exact characters of Morris's *D. illawarensis* as this was inadequately

described and only a portion of a valve figured. The present shell agrees well with later figures and descriptions of the species. It shows considerable likeness to *D. mitchelli*, Eth. and Dun,* but differs in being more orbicular and in the ribs being wider in proportion to the spaces between them.

Geological Survey No. $\frac{1}{5085}$.

Locality: South bank of Wooramel River. Three miles east from Top Camp.

Genus *MYALINA*, de Koninck.

(Deser. Anim. Foss. Terr. Carb. Belgique 1844, p. 125.)

Myalina sp.

Plate V., figs. 6 a-b.

Two casts of an inequivalve, inequilateral shell probably belong to this genus. They are obliquely elongated and compressed posteriorly. The hinge line is straight and very long, although probably less than the greatest length of the complete shell. The presence of a striated hinge plate is shown on the cast by a deep furrow which is ridged longitudinally on the side corresponding to the exterior of the hinge plate. The anterior margin is straight and falls away abruptly from the umbo. The posterior part forms the greater portion of the shell. It is produced backwards and expanded. The ventral margins of both casts are incomplete but they seem to meet the hinge line in an obtuse angle and from there to be strongly curved in almost a semi-circle, meeting the anterior margin in a gentle curve. The umbones are terminal and on the cast acutely pointed and elevated above the hinge line. The left valve is more convex than the right, which is flattened ventrally.

The generic characters of *Myalina* are the terminal umbones, the striated hingeplate and the presence of triangular septa or myophores in the beaks, which are shown in the casts as deep slits beneath the beaks. Hind (Geol. Mag. 1893, p. 514) says "all these characters are shown in King's figures Pal. Soc. Vol. III., 1849, Mon. Perm. Foss., pl. XIV., figs. 1-13." On these figures the effect of the myophores as described by Hind cannot be recognised. A prolongation between the umbones of fig. 5 is a cast of the anterior adductor, which, according to King, "lies between the horizontal plates." From this it seems that where the cast of the cavity of the anterior adductor is not preserved, as in King's fig. 12, the only effect of the plates on the cast is the abrupt deflection of the margins of the valves down to the hinge, leaving the umbo as a sharply elevated point. The abrupt gap left thus between the two pointed umbones can scarcely be described as "slits in the cast." In the absence of any figures of *Myalina* showing these "slits" the present casts cannot be excluded from the genus *Myalina* on the absence of myophores.

A similar genus possessing a striated hinge plate is *Naiadites*, which differs in that the umbones are only sub-terminal and a small anterior lobe is present.

In 1907 casts of a mytiliform shell from Mingewew, W.A., were described as *Myalina? mingewewensis* by Etheridge, G.S.W.A. Bull 27, p. 24, pl. 4, fig. 5, pl. 6, figs. 3-4. One of these showed a costate ornamentation. The specimens described above give no indication of the character of the external

* Eth. and Dun. Mem. Geol. Surv. N.S.W. Palaeont. No. 5, Vol. II., pt. 1, p. 11, and figs. Fletcher, Records Austr. Museum, Vol. XVII., No. 1, p. 15.

ornamentation. Otherwise *M. mingewensis* differs from them in being slightly produced anteriorly and in having resilium furrows anterior to the umbones.

Geological Survey No. $\frac{1}{4954}$.

Locality: Two miles almost east of Survey Station R20, Wooramal River.

Genus STUTCHBURIA, Etheridge, jun.

(Records Australian Museum 1900, III., No. 7, p. 178.)

Stutchburia?

Plate V., fig. 7.

A small cast broken at the posterior margin is probably a member of this genus.

The shell is equivalve, very inequilateral, elongated; umbo subterminal, small; anterior margin rounded, narrow, shell widening posteriorly, a median sulcus present; traces of concentric ornamentation present; anterior muscle scar well marked with a very deep depression separating it from the umbonal slope; a small supplementary scar between the anterior adductor and the umbo; dorsal margins erect; hinge edentulous anteriorly but posteriorly one side of the hinge plate shows a ridge which may represent a posterior lateral tooth.

The possession of a posterior lateral but no cardinal teeth is a characteristic of the genus *Clidophorus* Hall, but as no references to this genus can be found, further comparison is impossible.

In all other characters this cast agrees with *Stutchburia*.

Geological Survey No. $\frac{1}{4957}$.

Locality: Two miles almost east of Survey Station R20, Wooramal River.

Genus CONULARIA, Miller.

Conularia warthi, Waagen.

1886 *Conularia*, cf. *irregularis* (Kon.) Waagen, Rec. Geol. Surv. India, Vol. XIX., p. 26, pl. 1, fig. 2 (non C. irregularis Koninek.).

1889-91 *C. warthi*, Waagen, Salt Ra. Foss. (Pal. Ind.), Vol. IV., p. 126, pl. IV., figs. 6 a-d, pl. V., figs. 1 a-b.

1912 C. sp. nov.? cf. *C. warthi*, Glauert, Rec. W.A. Museum, Vol. I., pt. II., p. 76.

1931 *C.* cf. *C. warthi*, Hosking, R.S.W.A., Vol. XVII., p. 36, pl. XI., figs. 3-6.

A specimen recently collected from the Wooramal area shows the rhombic cross section and the ornamentation typical of *C. warthi*, i.e., granulated ribs, very fine irregular markings extending across the spaces between the ribs and a row of intercostal tubercles on each side of the lateral furrows. This specimen confirms the identification of previous specimens from the Wooramal area which showed granulated ribs but which were not well enough preserved to show the markings between the ribs and the intercostal tubercles.

Geological Survey No. $\frac{1}{5230}$.

Locality: Two miles almost east of Survey Station R20 in cliff on south banks of Wooramal River.

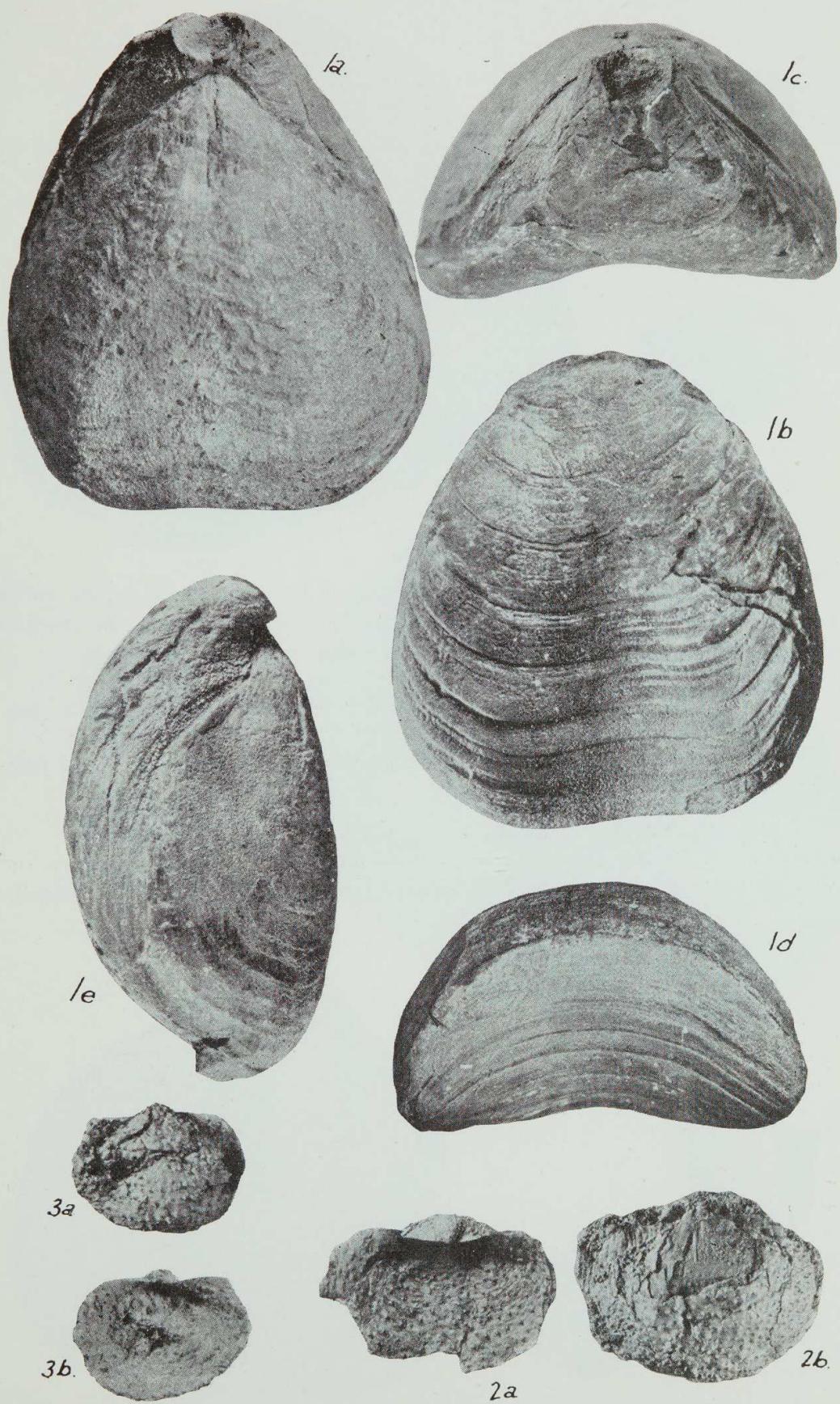


Photo. H. Smith

EXPLANATION OF PLATES.

All figures are natural size unless otherwise stated.

PLATE III.

Figs. 1a-e.—**Dielasma trignopsis**, n. sp., pedicle, brachial, posterior, anterior and lateral views of specimen $\frac{1}{4950}$. The pedicle valve, which may appear convex in fig. 1b owing to an optical illusion, is shown to be concave in figs. 1c and 1d.

Figs. 2-3b.—**Pustula senticosa**, n. sp., brachial and pedicle views of two specimens. In 2b the cardinal process and part of the interior of the brachial valve are exposed where the pedicle valve is broken away.

PLATE IV.

Figs. 1-2.—*Dielasma trigonopsis*, n. sp., 1a and b brachial and pedicle views of one of the largest specimens; 2, specimen showing a slight sinus in the brachial valve dividing the elevated central portion into two rounded ridges.

Fig. 3.—*Linoprotectus* cf. *L. tenuistriatus*, de Vern., var. *foordi*, Eth., jun.

Fig. 4.—*Pustula micracantha*, n. sp., pedicle and brachial views of the combined valves.

Fig. 5.—*Spiriferina cristata*, Schlotheim, pedicle valve.

Figs. 6-7.—*Spiriferina cristata*, Schlotheim, var. *decipiens*, n. var., fig. 6 pedicle valve, fig. 7 brachial valve.

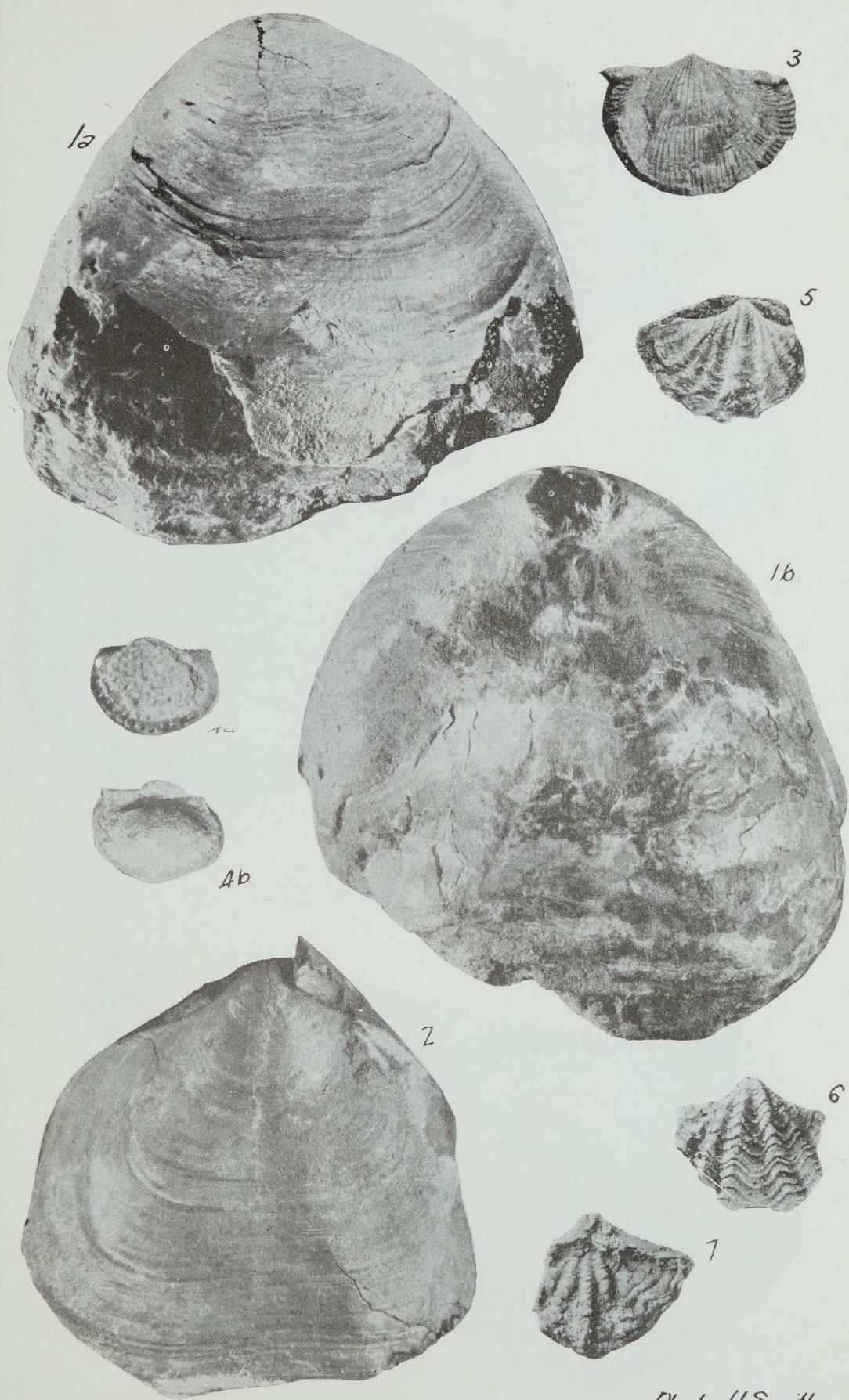


Photo. H. Smith

PLATE V.

Fig. 1.—*Spirifer* sp.

Figs. 2-5.—**Seminula callytarrensis**, n. sp., 2a-e pedicle, brachial, lateral, posterior and anterior views of the same specimen. Fig. 2a is very slightly enlarged; 3, pedicle valve showing spondylium and fine perforation at apex, the large hole shown in the umbo in Fig. 2b is due to breaking of the specimen; 4 and 5, anterior views of the two sectioned specimens (see text fig. 2) showing variation in convexity and in the size of the sinus.

Figs. 6a-b.—*Myalina* sp.

Fig. 7.—*Stutchburia* sp.

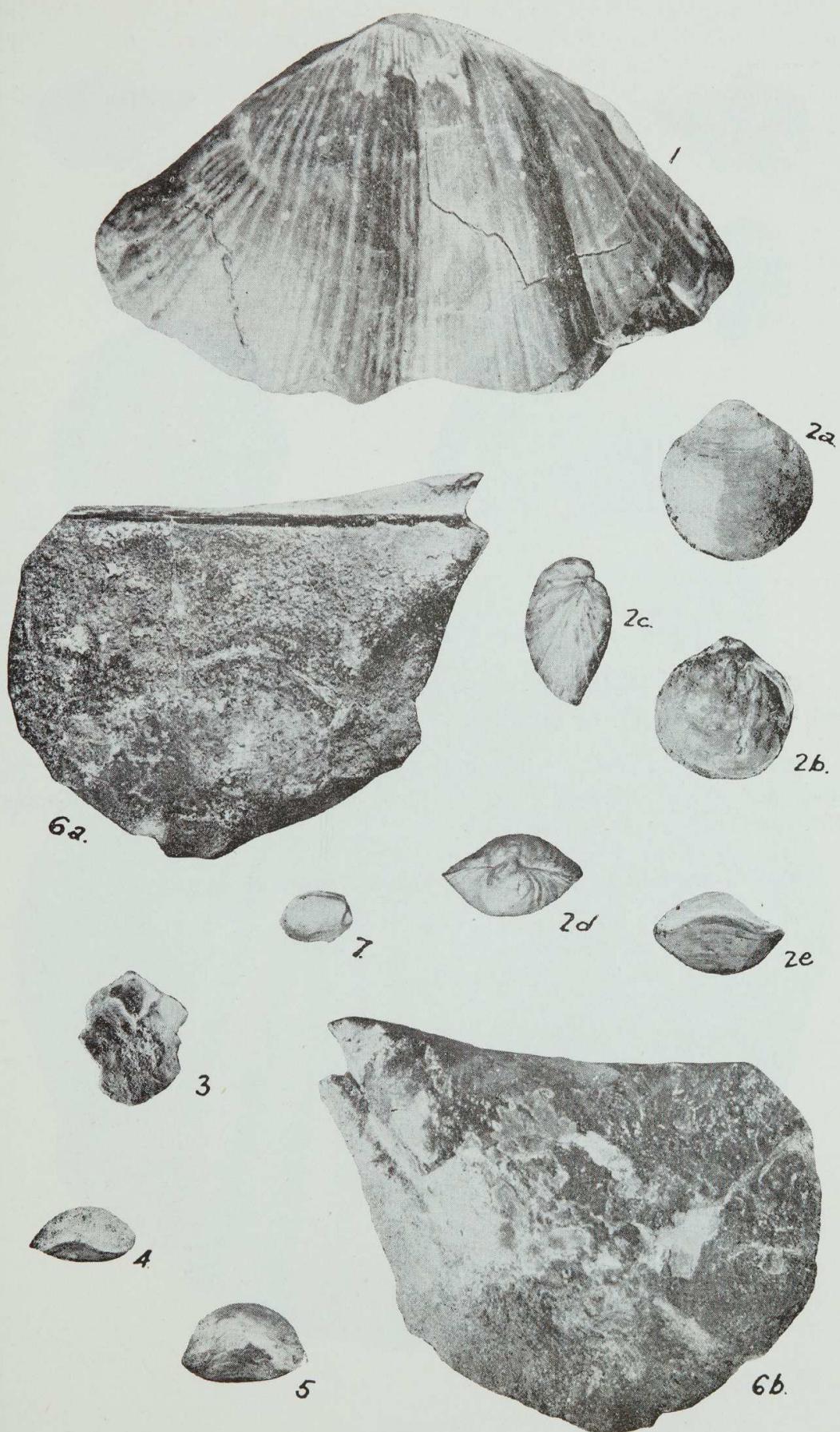


Photo. H. Smith

PLATE VI.

Figs. 1 and 2.—**Spiriferina papilionata**, n. sp., 1a-d pedicle, posterior, lateral, and interior views of one specimen; 2, brachial view of combined valves.

Fig. 3.—*Cardiomorpha blatchfordi*, Hosking, showing portion of shell. The other side of this specimen (1/4951) shows the coarse rugae and is identical with specimens previously described.

Fig. 4.—*Deltopecten i lawarrensis*, Morris ($\frac{1}{26}$ th natural size).

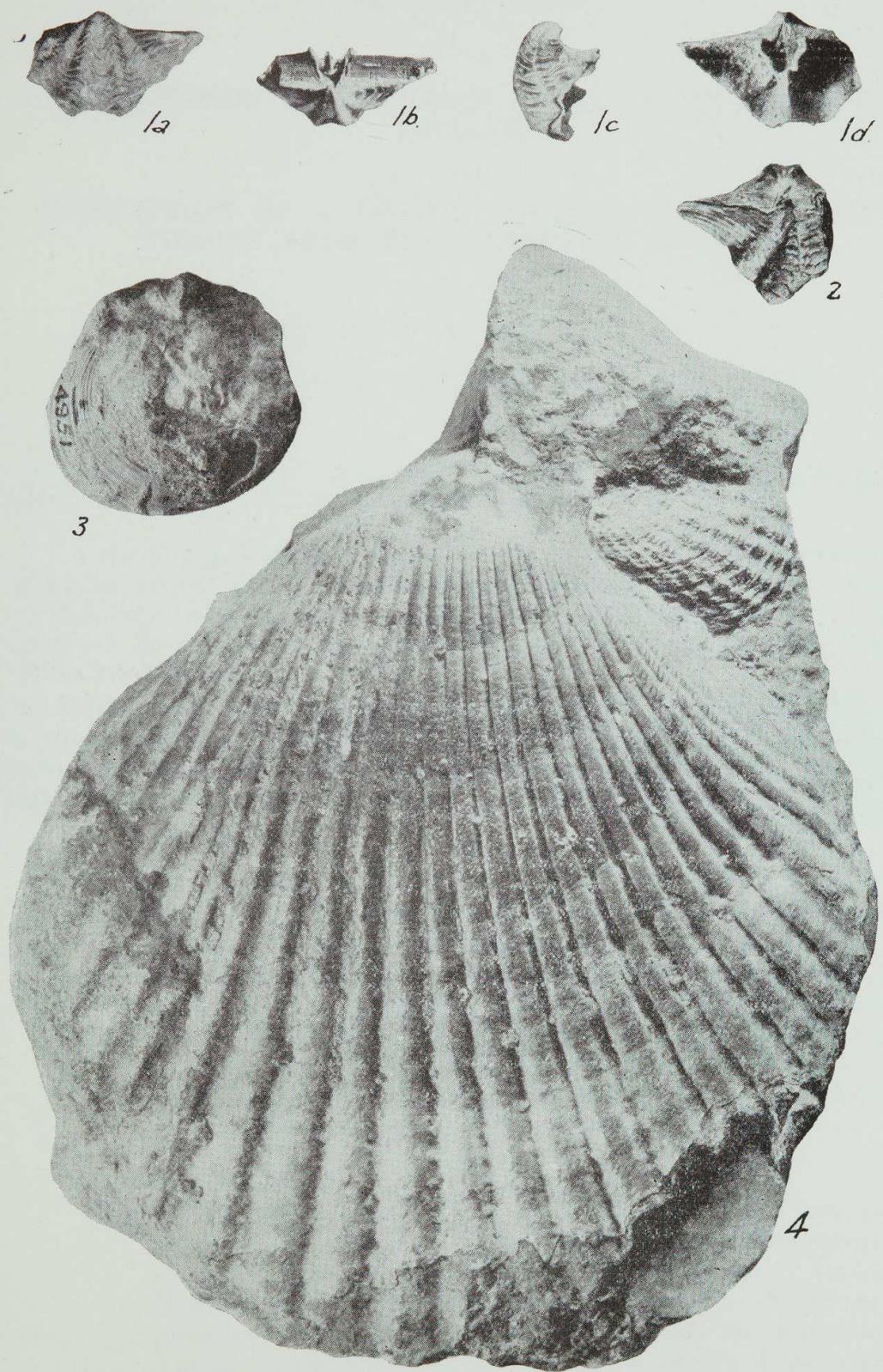


Photo. H. Smith

Plate VI.

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